

What is claimed is:

1. A fusion protein comprising
 - 5 (a) a recombinase domain comprising a recombinase protein or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type recombinase, and
 - (b) a signal peptide domain linked to said recombinase domain which directs nuclear import of said fusion protein in eucaryotic cells.
- 10 2. The fusion protein of claim 1, wherein the activity of the fusion protein in eucaryotic cells is significantly higher as compared to that of the wild-type recombinase corresponding to the recombinase of the recombinase domain.
3. The fusion protein of claim 1, wherein the recombinase domain comprises a recombinase protein belonging to the family of large serine recombinases or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type recombinase.
- 20 4. The fusion protein of claim 3, wherein the recombinase protein is selected from the group consisting of bacteriophage Φ C31 integrase (C31-Int), coliphage P4 recombinase, Listeria phage recombinase, bacteriophage R4 Sre recombinase, CisA recombinase, XisF recombinase, transposon Tn4451 TnpX recombinase and lactococcal bacteriophage TP901-1 recombinase or a mutant thereof having a
25 recombinase activity similar to that of the corresponding wild-type recombinase.
5. The fusion protein of claim 4, wherein the recombinase protein is a C31-Int protein or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type C31-Int protein.
- 30 6. The fusion protein of claim 1, wherein the recombinase domain comprises a C31-Int protein having the amino acid sequence shown in SEQ ID NO:21.
7. The fusion protein of claim 5 comprising a C-terminal truncated form of said
35 C31-Int protein.

8. The fusion protein of claim 7, wherein said truncated form of the C31-Int protein comprises amino acid residues 306 to 613 of SEQ ID NO:21.

5 9. The fusion protein according to claim 1 or 5, wherein the signal peptide domain is derived from a protein selected from the group consisting of yeast GAL4, yeast SKI3, yeast L29, yeast histone H2B, polyoma virus large T protein, VP1 capsid protein, VP2 capsid protein, SV40 VP1 capsid protein, VP2 capsid protein, adenovirus E1a, adenovirus DBP, influenza virus NS1, hepatitis virus
10 core antigen, mammalian lamin, mammalian c-myc, mammalian max, mammalian c-myb, mammalian p53, mammalian c-erbA, mammalian jun, mammalian Tax, mammalian steroid receptor, mammalian Mx, and SV40 T-antigen.

5 10. The fusion protein of claim 9, wherein the signal peptide is derived from the SV40 T-antigen.

11. The fusion protein of claim 9, wherein the signal peptide domain has a length of 5 to 74 amino acid residues,

20 12. The fusion protein of claim 11, wherein the signal peptide domain has a length of 7 to 15 amino acid residues.

13. The fusion protein of claim 9, wherein the signal peptide domain comprises a
25 segment of 6 amino acid residues having at least 2 positively charged basic amino acid residues.

14. The fusion protein of claim 13, wherein said basic amino acid residues are selected from lysine, arginine and histidine.

30 15. The fusion protein of claim 9, wherein the signal peptide domain comprises a sequence selected from the group consisting of any one of SEQ ID NOs:24 to 53.

16. The fusion protein of claim 9, wherein the signal peptide domain comprises
35 the amino acid sequence Pro-Lys-Lys-Lys-Arg-Lys-Val (SEQ ID NO:53).

17. The fusion protein of claim 1, wherein the signal peptide domain is linked to the C-terminal of the recombinase domain.

5 18. The fusion protein of claim 1, wherein the signal peptide domain is linked to the recombinase domain through a linker peptide

19. The fusion protein of claim 18, wherein said linker has 1 to 30 essentially neutral amino acid residues.

10

20. The fusion protein of claim 1 comprising the amino acid sequence shown in SEQ ID NO:23.

21. A DNA coding for a fusion protein comprising

5 (a) a recombinase domain comprising a recombinase protein or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type recombinase, and

(b) a signal peptide domain linked to said recombinase domain which directs nuclear import of said fusion protein in eucaryotic cells.

22. The DNA of claim 21, wherein the recombinase protein is a C31-Int protein or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type C31-Int protein.

25 23. The DNA of claim 21 which codes for the amino acid sequence shown in SEQ ID NO:23.

24. A vector containing the DNA as defined in claim 21.

30 25. A microorganism containing the DNA of claim 21 or the vector of claim 24.

26. A process for preparing a fusion protein as defined in claim 1 which comprises culturing a microorganism as defined in claim 25 under conditions suitable for expression of said fusion protein and recovering said fusion protein.

35

27. A method for recombining a DNA molecule containing recognition sequences for a recombinase protein in a eucaryotic cell, said method comprising contacting the cell with a fusion protein according to claim 1 that recognizes said recognition sequences, wherein the fusion protein catalyzes recombination of the DNA molecule.

28. A cell containing a DNA sequence coding for a recombinase fusion protein in its genome, said recombinase fusion protein comprising

(a) a recombinase domain comprising a recombinase protein or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type recombinase, and

(b) a signal peptide domain linked to said recombinase domain which directs nuclear import of said fusion protein in eucaryotic cells.

29. The cell of claim 28 which is a mammalian cell.

30. The cell of claim 28 also containing recognition sequences for the recombinase protein of the recombinase domain in its genome.

31. A transgenic organism containing a DNA sequence coding for a recombinase fusion protein in its genome, said recombinase fusion protein comprising

(a) a recombinase domain comprising a recombinase protein or a mutant thereof having a recombinase activity similar to that of the corresponding wild-type recombinase, and

(b) a signal peptide domain linked to said recombinase domain which directs nuclear import of said fusion protein in eucaryotic cells.

32. The transgenic organism of claim 31 which is a transgenic non-human mammal.

33. The transgenic organism of claim 31 also containing recognition sequences for the recombinase protein of the recombinase domain in its genome.

34. A method for recombining DNA molecules of cells or organisms containing recombinase recognition sequences for a recombinase protein of the recombinase

domain of the fusion protein as defined in claim 1, which method comprises supplying the cells or organisms with a fusion protein as defined in claim 1 or with a DNA sequence of claim 21 or with a vector of claim 24 which are capable of expressing said fusion protein in the cell or organism.